

on these several branches are noticed in greater or less detail, and there is appended an ample "Bibliography of Anthropology, 1885," which is arranged in alphabetical order, and which will be found most useful for purposes of general reference. It includes not only independent works and memoirs, but also special papers bearing on the subject, which have been contributed in the specified period to various English, American, French, German, and other scientific journals. Amongst the essays more fully noticed are M. Gabriel de Mortillet's work on "The Precursor of Man," advancing the theory that the flints of Thenay were the workmanship, not of man as fully developed, but of his immediate predecessor, the anthropopithecus; Dr. Lissauer's paper on human craniology, introducing the sagittal suture as a new element in obtaining anthropological measurements; Dr. Hermann Welcker's treatise on the capacity of the cranium in connection with the three diameters, with classifications of races according to their skull capacity; Dr. Topinard's masterly work on genera' anthropology, from which copious extracts are made; Dr. Otto Stoll's contribution to the comparative philology of Central America, embodying a scientific classification of the eighteen languages still current in Guatemala. Here the Maya family is specially dealt with and divided into four distinct groups: Tzentel (Chendal), Pokonchi, Quiché, and Marne. It is incidentally mentioned that in 1885 the Woman's Anthropological Society was organised in Washington under the presidentship of Mrs. Tilly Stevenson. The object of this association is stated to be "to conduct investigations to which the avenues are especially open to women, and to encourage the sex in the prosecution of scientific work."

THE catalogue of the Library of the Chemical Society, arranged according to subjects with indexes containing authors' names and subjects, will be useful to chemists.

VOL. I. of "Studies from the Biological Laboratories of the Owens College" (Manchester: Cornish) is mainly a reprint of papers that have appeared in various journals.

WE have received the last (19th) Report of the Peabody Institute of Baltimore. There is no marked advance over past years in any department, but all have been prosperous and the results attained have been satisfactory. The attendance at the courses of lectures was exceptionally large, but the use of the library has been somewhat reduced owing to the opening of another free public library in Baltimore. Amongst the lectures during the year were courses on Arctic Explorations and Life in the Arctic Regions, on Mexico, Ancient and Modern, on the Mound Builders of Ohio, and on the Poetry of Science.

MR. C. G. ROCKWOOD, jun., of Princeton, N.J., writes that the shock of earthquake at Sandy Hook, New York, of June 11, noticed in NATURE of June 17 (p. 153) is an error. The tremor which was felt in that vicinity at the time stated, and which was at first reported as an earthquake, was afterwards traced to the firing of heavy guns on board the U.S.S. *Funiata*, at that time approaching Sandy Hook.

THE additions to the Zoological Society's Gardens during the past week include a White-handed Capuchin (*Cebus hypoleucus*) from Brazil, presented by Madam Sangiorgi; a Levaillant's Cynictis (*Cynictis penicillata* ♂), five Suricates (*Suricata tetradactyla* ♂ & ♀ & ♀), two Triangular Spotted Pigeons (*Columba guinea*), three Vinaceous Turtle Doves (*Turtur vinaceus*), two Cape Turtle Doves (*Turtur capicola*) from South Africa, presented by Mr. R. A. Fairclough; two Red Foxes (*Canis fulvus* ♂ & ♀) from North America, presented by Messrs. Enson, Weber, and Co.; a Masked Paradoxure (*Paradoxurus larvatus*) from Hong Kong, presented by Mr. J. Orange; five Forster's Milvagos (*Milvago australis*) from the Falkland Islands, presented by Mr. James Moore; a Tawny Owl (*Syrnium aluco*),

British, presented by Master C. G. Gregory; five Common Toads (*Bufo vulgaris*) from the South of France, presented by Mrs. F. Walker; a King Vulture (*Gypagus papa*) from Brazil, deposited; three Lions (*Felis leo* ♂ & ♀ & ♀) from Africa, a Grey Squirrel (*Sciurus cinereus*), a Mink (*Putorius vison*), three Hudson's Bay Squirrels (*Sciurus hudsonius*), a Virginian Eagle Owl (*Bubo virginianus*) from North America, purchased; two Mule Deer (*Cariacus macrotis* ♂ & ♂), born in the Gardens.

ASTRONOMICAL PHENOMENA FOR THE WEEK 1886 AUGUST 1-7

(FOR the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

At Greenwich on August 1

Sun rises, 4h. 26m.; souths, 12h. 6m. 49s.; sets, 19h. 46m.; decl. on meridian, 17° 59' N.: Sidereal Time at Sunset, 16h. 27m.

Moon (one day after New) rises, 5h. 59m.; souths, 13h. 19m.; sets, 20h. 26m.; decl. on meridian, 11° 23' N.

Planet	Rises h. m.	Souths h. m.	Sets h. m.	Decl. on meridian
Mercury ...	6 43 ...	13 26 ..	20 9 ...	7 52' N.
Venus ...	1 45 ...	9 54 ...	18 3 ...	22 29' N.
Mars ...	10 55 ...	16 23 ...	21 51 ...	7 0' S.
Jupiter ...	9 27 ...	15 31 ...	21 35 ...	0 5' N.
Saturn ...	2 21 ...	10 28 ...	18 35 ...	22 10' N.

Occultations of Stars by the Moon (visible at Greenwich)

Aug.	Star	Mag.	Disap.	Reap.	Corresponding angles from vertex to right for inverted image
5 ...	95 Virginis ...	6 ...	21 54 ...	22 53 ...	108 297
5 ...	94 Virginis ...	6 ...	22 3 ...	near approach	202 —

Aug. h. m. I ... 15 ... Mercury stationary.

Variable Stars

Star	R.A.	Decl.	h. m.
U Cephei ...	0 52' 2 ...	81 16' N. ...	Aug. 2, 22 30 m
λ Tauri ...	3 54' 4 ...	12 10' N. ...	3, 22 12 m
U Monocerotis ...	7 25' 4 ...	9 32' S. ...	6, M
S Virginis ...	13 27' 0 ...	6 37' S. ...	1, m
V Coronæ ...	15 45' 5 ...	39 55' N. ...	5, M
U Ophiuchi ...	17 10' 8 ...	1 20' N. ...	2, 0 38 m
R Scuti ...	18 41' 4 ...	5 50' S. ...	1, M
η Aquilæ ...	19 46' 7 ...	0 43' N. ...	5, 21 30 m
δ Cephei ...	22 24' 9 ...	57 50' N. ...	4, 0 0 m

M signifies maximum; m minimum.

Meteor Showers

Showers have been observed at this season from the following radiant:—The *Andromedes* (I.), from R.A. 8°, Decl. 36° N.; from Camelopardus, R.A. 12°, Decl. 70° N.; near η Persei (the *Perseids*), R.A. 45°, Decl. 56° N.; near η Herculis, R.A. 254°, Decl. 37° N.; near λ Aquarii, R.A. 342°, Decl. 9° S.; from Lacerta, R.A. 342°, Decl. 40° N.; and one near Fomalhaut, R.A. 342°, Decl. 34° S.

Stars with Remarkable Spectra

Name of Star	R.A. 1886°	Decl. 1886°	Type of spectrum
D.M. + 44° 3877 ...	21 31 42 ...	44 51' 9' N. ...	III.
249α Schjellerup ...	21 37 13 ...	34 59' 4' N. ...	IV.
μ Cephei ...	21 40 1 ...	58 15' 4' N. ...	III.
254 Schjellerup ...	21 40 41 ...	2 44' 4' S. ...	III.
258 Schjellerup ...	21 59 1 ...	27 47' 8' N. ...	III.
18 Cephei ...	22 0 26 ...	62 33' 8' N. ...	III.
D.M. + 56° 2821 ...	22 34 8 ...	56 12' 2' N. ...	III.
β Pegasi ...	22 58 14 ...	27 27' 8' N. ...	III.

THE VOLCANIC ERUPTION IN NEW ZEALAND

FURTHER details have been received of the volcanic eruption in the Hot Lake district of New Zealand, which has been the scene of a terrible and unexpected catastrophe which

occurred early on the morning of June 10. At Ohinemutu, on Lake Rotorua, the earth began to tremble at midnight. At ten minutes past 2 a.m. there was a heavy quake and a loud roaring noise which startled the inhabitants and caused them to flee from their houses. From this point it could be seen that Mount Tarawera, about fourteen miles distant, had suddenly become an active volcano, belching out fire and lava to a great height. At 4 a.m. a dense mass of ashes poured down, accompanied by suffocating smells. A large black cloud, which extended in a line from Mount Tarawera to the Pairua Mountains, was filled with flame and electricity. The thunder-like roar from the crater, the sulphurous smells and constant quaking of the earth, caused many of the inhabitants to leave their homes and proceed to Tauranga, a distant township on the east coast. At 8 a.m. the aspect of affairs was as bad as it was all night, and hundreds of boiling springs had broken out around Lake Rotorua. At 11 a.m. the eruptions were going on continuously, and all the country down to Tauranga was in total darkness, with thick clouds of dust and sulphurous fumes in the air. At one o'clock the darkness had all cleared away and the principal centres of eruption had subsided.

At Lake Taupo, about forty miles to the south of Tarawera, the spectacle presented was most extraordinary. At 2 a.m. the outbreak was heralded by terrific reports, which resembled the roar of artillery, while a pillar of flame shooting hundreds of feet into the air was observed in the locality of the eruption. A great black cloud hung over this pillar, whilst flashes of electricity shot out from the cloud in every direction, shedding an unearthly bluish light. Loud reports, accompanied by heavy shocks of earthquake, followed in quick succession, and kept on until six o'clock, when the daylight and clouds of ashes rendered the sight invisible.

At Tauranga, forty-seven miles distant to the north-east, loud reports of heavy earthquakes began at 2.15 a.m., and very severe shocks were experienced at 3 a.m., while in the direction of the outbreak the country was illuminated for hours with flames and lightning. In the neighbourhood of Maketu, fifty miles to the east of the principal centre of eruption, atmospheric disturbances caused darkness till 10 a.m., and the shocks of earthquake were accompanied with strong lightning and earth currents, while at Hamilton, eighty miles to the west, the volcanic discharges are said to have resembled the firing of great guns at sea.

The devastation caused by the eruption is very widespread, and it is believed that all the natives round Rotomahana and Tarawera Lakes must have died. About a hundred Maoris are known to have perished. Mr. Haszard, the schoolmaster at Wairoa, and his four children and niece, and an English tourist named Bambridge are the only Europeans known to be killed. The country for fifty miles around the vicinity of the disturbance has been covered by the discharge of stones and ashes, and large craters have risen up. Mount Tarawera is elevated 300 feet higher than before. Lake Rotomahana has subsided, and has been transformed into an expanse of seething mud, and the renowned terraces are reported to be destroyed. Large areas are covered with volcanic dust and mud. During the disturbance the wind blew from the east, heavy snow fell on the ranges, and there was intense cold.

The wide area forming the scene of the eruption has been the chief centre of volcanic activity in New Zealand since the country has been known to Europeans, and in fact since the earliest period of Maori tradition. The region forms of itself a distinct volcanic zone remarkable for its picturesque hot lakes, boiling geysers, and numerous thermal springs. For many years it has been the resort of tourists from all parts of the world, and who reached it by way of Tauranga, a picturesque town on the east coast of the North Island, with a fine harbour opening into the Bay of Plenty. It is in this bay, about 30 miles from the mainland, that the first indication of volcanic activity presents itself in the form of Whakari, or White Island, a cone-shaped mountain which rises abruptly from the sea to an altitude of 860 feet. The crater, about $1\frac{1}{2}$ miles in circumference, is in a condition of a very active *solfatara*, whose numerous geysers and boiling springs evolve at all times dense volumes of steam and sulphurous gases.

From Tauranga the traveller proceeds in a southerly direction through a fern-clad country interspersed with broad belts of primæval forest presenting the most luxuriant and varied vegetation. In a distance little short of 40 miles the land rises gradually to an altitude of 800 feet, when the great table-land of the

Lake Region is reached. Here, in a depression which appears to have formed at some remote period the area of an immense lake-basin, is situated the township of Ohinemutu, where there are several good hotels and a small white population. Just beneath the township the blue surface of Lake Rotorua, with the picturesque Island of Mokoia in its centre, spreads itself out in a circle of nearly 25 miles. The area in the immediate vicinity of the lake, where the action of the thermal springs is most active, extends from Whakarewrewa on the one side to Te Koutu on the other, and inland to Tikitere and Arikapa, celebrated for its big holes of black boiling mud. Hot springs occur on its southern shore, while still further to the east of it again are the warm lakes known as Rotorua and Rotoehu. The native settlement is situated on a long peninsula stretching out into the waters of Lake Rotorua. Every part of this strip of land is dotted and riddled with thermal springs, some of which shoot out of the ground from small apertures, while others assume the forms of large steaming pools. They are of all degrees of temperature from tepid heat to boiling-point. Here the *whares* or huts of the natives are clustered promiscuously about the springs, and in situations where a few inches below the surface the soil is sufficiently hot to cook an egg in a few minutes.

It is this region which may be said to contribute the first link in the chain of active thermal action, extending from Whakari in the Bay of Plenty, through the Lake Country, to the active volcano of Tongariro, in the centre of the island, a distance in a direct line of about 130 miles.

At a distance of about nine miles still southerly from Lake Rotorua, lies Lake Tarawera, with its cluster of minor lakes, which constitute the second and most important connection in the volcanic belt. It was here the recent volcanic disturbance first declared itself in the sudden activity of Mount Tarawera, an extinct volcanic cone which had remained quiescent since time immemorial.

No place in the world could boast of scenery so unique and thermal phenomena so marvellous as could Tarawera and its surroundings. It was reached from Tarawera by a delightful route fringed by fern-clad mountains, and through the Sikitapu Forest one of the grandest gardens of primeval vegetation in New Zealand, but which is now uprooted by the force of the subterranean devastation. At the southern exit of the forest the traveller was charmed by Sikitapu, the Blue Lake, and Rotokakahi, the Green Lake, whose calm picturesque beauty formed one of the grandest sights of this singularly gifted region. A few yards from this point nestled the native settlement of Wairoa, now covered with 10 feet of ashes. Here were two hotels for the accommodation of tourists, who came from places far and wide to visit the wonders of the Terraces. From time out of mind it had been one of the principal homes of the great Arara tribe, who claim to be the pioneers of the race in New Zealand.

Down a wild gorge from Wairoa Lake Tarawera lies embosomed in a circle of tall forest-clad mountains, whose pointed peaks and serrated ridges betoken at once their Plutonic origin, while on the southern shore of the Lake rises Mount Tarawera, in the form of a colossal truncated cone, with pointed peaks like a spiked crown. It was out of this giant mountain *tapu*, and sacred in Maori song and legend, that the recent subterranean fires first shot forth, enveloping the whole mountain in a sheet of flame.

A glance at this mountain and the surrounding region was sufficient to show that at some remote period it must have been—as now—the chief centre of a widely-extended volcanic action. The mountain itself formed one of the principal volcanic cones to be found dotted over the country. A range of volcanic hills sloped down on its western side to Lake Rotomahana, which was connected with Lake Tarawera by a small warm stream known as Te Arikia. Before the eruption occurred the shores of the former lake formed the principal point of thermal activity in the district, and there can be little doubt that beneath its surface the forces which culminated in the outbreak of Mount Tarawera were evolved.

Lake Rotomahana, now said to be nothing more than a hole of seething mud and vaporous gases, formed in reality the wonderland of the region. Like Lake Tarawera, it was situated at an elevation of a little over 1000 feet above the level of the sea. It was one of the smallest of the group of lakes, being about a mile long by a quarter of a mile wide. It was, however, grandly picturesque, not only by reason of its unequalled features presented by the terraces, but likewise on account of

its steaming shores with their countless hot springs, boiling geysers, steaming cauldrons, and seething mud-pools, as well as by the bold, rugged scenery which surrounded it on every side. The name Rotomahana in the native language means literally "hot lake." The mean temperature of the water was about 80° F., while in the vicinity of the hot springs it rose frequently to 212° F.

It was on either shore of this lake that the marvellous terraces now unfortunately reported to be destroyed were situated. The largest of these singular formations was Te Tarata, or the White Terrace, the outline of which assumed a semicircular form and spread out at its base as it sloped gently down to the margin of the lake; the broad, flat, rounded steps of pure white silica rose tier above tier white and smooth as Parian marble and above them terrace after terrace mounted upwards, rounded and semicircular in form. All were formed out of a delicate tracery of silica, which appeared like lacework congealed into alabaster of the purest hue; crystal pools shaped as if to resemble the form of shells and leaves, and filled to their brims with water blue and shining as liquid turquoise charmed the eye, while around the edges bright crystals of silica formed incrustations which made them appear as if set with a margin of miniature pearls. At the summit of the terrace was a crater of 200 feet in diameter filled to overflowing with brilliant transparent water in the form of a boiling fountain, from which clouds of steam floated constantly upward. This boiling spring formed an intermittent geyser, which during its active intervals threw up a column of water to a height of over 100 feet. The crater, however, was always overflowing, and the water, which was highly charged with silica, had by a gradual process of deposition, extending probably over a vast period, formed the present system of terraces. The temperature of the water varied from boiling point to 70° F. at the foot of the terrace, the summit of which was over 80 feet above the level of the lake.

Immediately at the back of the White Terrace and bordering the lake was a rocky desolate gorge seamed and furrowed in every direction with streams of hot water, while jets of hissing steam bursting from its sides marked the sites of subterranean fires. The high hills on each side of the gorge rose up in quaint fantastic shape, and their rugged sides composed of shattered volcanic rock sent forth water and jets of steam from a thousand fissures. Here boiling geysers emitting clouds of steam lashed their hot waves about and foamed with a furious sound in rock-bound basins, while scattered over the greater portion of this fiery wilderness were innumerable fumaroles all hard at work shooting out steam and vomiting black streams of liquid mud. Some of these were round, some flat, and others cup-shaped, while not a few assumed the form of miniature volcanoes.

It was opposite to this spot on the further shore of the lake, that Te Otukapurangi, or the "Fountain of the Clouded Sky" of the Maoris, or the Pink Terrace, rose from the water of the lake to an altitude of nearly 100 feet. Here the deposits of silica assumed the same general formation, and each terrace of steps was gracefully and marvellously shaped with rounded edges which swept about in waving curves. The various buttress-like masses which supported the fringed edges of the terraces bent over and formed miniature grottoes resplendent with festoons of pink-tinted silica and rose-coloured stalactites which appeared to have been woven together by nature into an intricate network and then crystallised into their present shape. Here the successive deposits or layers of silica-rock did not assume, like those of Te Tarata, a wonderful combination of delicate lacework around the edges of the terraces, but the siliceous laminations appeared even thinner, and reminded one of the corrugated surface of pink satin rep. It was, however, the variegated tints of this wondrous structure which rendered it even more remarkable than the gracefully symmetrical proportions of its incomparable design. As the blue-tinted water came rippling and falling from terrace to terrace in miniature cascades, Te Otukapurangi looked radiant in its sparkling mantle of delicate pink, and as the golden rays of the sun shot far and wide, it changed with every shade of light, with brilliant hues of pink, amber, carmine, and yellow, which shone with a dazzling and metallic lustre as they flashed and palpitated as it were in the warm glowing air.

At the summit of the terrace was a circular platform, in the centre of which was a steaming cauldron formed by an alabaster-like basin about 100 feet in diameter. Here the deep dark-blue water within a few degrees of boiling-point lay without a ripple upon its surface, and shone with the brilliancy of transparent

crystal, while beneath the siliceous deposits, which encrusted the sides of the crater, assumed all the varied designs of a coral grove tinted in glowing colours of yellow, blue, and pink.

From Lake Rotomahana the recent volcanic eruption extended to the Pairoa Mountains, which attain to an altitude of 1000 feet, and which, when visited by Mr. Kerry-Nicholls, were hot, and quaking with internal fires, boiling mud pools, and coiling jets of steam that burst with a hissing sound from the deeply-scarred hills. The base of this range, where the volcanic action was greatest, was formed of a burnt fiery-looking earth, broken here and there into enormous fissures, and dotted about with boiling pools and deep holes of hot seething mud, while clouds of vapoury steam burst forth from the highest peaks.

Following up the line of thermal activity across the island, as yet not known to be affected by the recent outbreak, hot springs and geysers are found at Orakeikorako on the banks of the Waikato and in various places along the whole valley of the rivers, and notably at Wairakei, where the thermal activity is both widespread and extraordinary in its variety. At Taupo, the great central lake of the island, geysers and other phenomena of the kind exist on its northern shores. From this point further across the lake the hot springs and geysers of Tokanu occur, while a short distance beyond rises the cone-shaped form of Tongariro, at an altitude of 7000 feet, the two craters which are in a state of very active *solfatara* constantly emit vast volumes of steam. Five miles to the south of the latter mountain rises the colossal form of Mount Ruapehu, which, with a base of over sixty miles, rises to an altitude of 6000 feet to the region of perpetual snow. This mountain, which was at one time the chief centre of volcanic activity of the north island, has been extinct from time immemorial, but it is reported that during the recent eruption steam was seen to issue from the crater. It is the highest point of the north island, and was ascended by Mr. Kerry-Nicholls and his interpreter, Mr. Turner, in 1883.

SCIENCE IN NEW SOUTH WALES

IN his Annual Address (on May 5) to the Royal Society of New South Wales, the President, Prof. Liversidge, referred to the death of Prof. Smith, the former President of the Society, and to the eminent services which he had rendered to the cause of science and of education in New South Wales, and also to other members of the Society who died during the past year. The President then expressed regret that the number of original papers contributed to the Society is so small. "It is not," he said, "from lack of subjects, for there are many questions which require investigation, but rather from the lack of competent investigators who can spare the necessary time. Up to the present but little original work has been done in working out the chemistry of the mineral and vegetable products, and but very little in many branches of biology. The descriptions, catalogues, lists, &c., of the flora and fauna, are making fair progress, but still very little has been published relating to the development and life-history of the fauna of Australia, even of forms of life peculiar to that part of the world. In matters of natural history, geology, and allied subjects it is apparent to every one that the materials for original work are in New South Wales abundant, and a considerable amount of very valuable work is being done in this direction by the Linnean Society of New South Wales, but the amount waiting to be done is far more than they can cope with at present. The Society, by offering a medal and a money prize, has done what it can to stimulate research; but the amount at its disposal is small. So many subjects if thoroughly worked out would be of economic value to the colony—such as the chemistry of Australian gums and resins, the tin deposits, iron ores, and silver ores of New South Wales—that the Government might with propriety assist the Society in undertaking these researches. Wealthy colonists might also, with advantage to the State and credit to themselves, encourage such original investigation." Speaking of biological work, the President said that one of the few facilities for scientific work possessed in Sydney, and which the Society assisted in founding, viz. the biological laboratory at Watson's Bay, has been closed, the Government having taken the house and grounds for defence purposes. The trustees will doubtless receive the cost of the buildings, and with this as a nucleus a fresh start can be made. It would be a great pity to allow such an undertaking to drop, especially as there is such an unlimited field for marine biological work in Australia. In regard to scientific education.